

Hydraulic Conduction (2500015)

General Information

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| School | ETSECCPB |
| Departments | Departament d'Enginyeria Civil i Ambiental (DECA) |
| Credits | 6.0 ECTS |
| Programs | GRAU EN ENGINYERIA CIVIL (pla 2020) PARS: ENGINYER/A DE CAMINS, CANALS I PORTS (pla 2022) |
| Course | 2024/25 |

Main teaching language at each group

- Group 11CA2 Catalan (Q2)
- Group 12CA2 Catalan (Q2)
- Group 21CA2 Catalan (Q2)
- Group 22CA2 Catalan (Q2)
- Group 31EN2 English (Q2)
- Group 32EN2 English (Q2)

Faculty

Responsible Faculty: Ernest Blade Castellet

Faculty: Ernest Blade Castellet, Maria Soledad Estrella Toral, Francisco Nuñez González, Marti Sanchez Juny

Objectives of Education

Knowledge of fluid characteristics: compressibility, viscosity, phase transition and surface tension. Fluid statics. Knowledge of the equations of fluid motion and their application to ducted flow. Continuity, momentum, Bernoulli's trinomial. Turbulent motion and Reynolds number. Permanent and variable flow in pipes, including the conservation of energy and pressure-drop analysis, as well as pumping systems. Knowledge of the permanent and variable flow and its application to the functioning of channels.

1 Ability to apply the equations of the fluid motion to engineering cases related to pressurised or open channel flow systems

2 Ability to solve problems related to pipe networks, including support elements such as fittings and valves.

3 Ability to analyze the open-channel water flow in basic geometries or conditions.

Knowledge of the concepts and technical aspects related to both pressure and free surface conduction systems. Ability to solve basic hydraulic problems in engineering. Understand the characteristics of fluids: compressibility, viscosity, phase transition and surface tension. Fluid statics.

Knowledge of fluid equations of motion and their application to ducted flow. Continuity, momentum, and Bernoulli's trinomial.

Turbulent movement and Reynolds number. Knowledge of permanent and variable flow in pipes, including energy conservation and the pressure-drop analysis, as well as pumping systems. Knowledge of permanent and variable flow in open channel flow systems and its application to the operation of channels.

Competencies

Especific

Escola de Camins

Knowledge of the concepts and technical aspects linked to the conduction systems, both in pressure and in free foil. (Common module to the Civil branch)

Knowledge and ability to project and size hydraulic works and installations, energy systems, hydroelectric uses and planning and management of surface and underground hydraulic resources. (Specific technology module: Hydrology)

Knowledge and understanding of the functioning of ecosystems and environmental factors. (Specific technology module: Hydrology)

Generic

Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.

Capacity for the maintenance and conservation of hydraulic and energy resources, in its field.

Knowledge of the history of civil engineering and training to analyze and assess public works in particular and construction in general.

Total hours of student work

| | | Hours | Percentage |
|---------------------|--------------------|--------|------------|
| Supervised Learning | Large group | 30.0 h | 45.45 % |
| | Medium group | 30.0 h | 45.45 % |
| | Laboratory classes | 0.0 h | 0.00 % |
| | Guided Activities | 6.0 h | 9.09 % |
| Self Study | | 84.0 h | |

Contents

Topic 1. Mechanical characteristics of fluids

Mechanical properties of fluids

Topic 2. Hydrostatics

Equations and basic principles

Exercises

Topic 3. Fundamental equations in the motion of fluids

Fundamental equations: Conservation of mass, momentum Theorem and Energy balance

Exercises

Topic 4. Flow under Pressurized conditions

Steady flow in pipelines

Exercises

Pumping systems

Exercises

Transients in pipes. Water-hammer

Exercises

Topic 5. Open channel flow

Uniform regime

Gradually varied flow

Exercises

Rapidly varied flow

Exercises

HECRAS model in steady flow
Introduction to the variable regime in open channel flow
Introduction to the HECRAS model in non-steady flow

Activities

HECRAS work

Dedication

6h

Teaching Methodology

The course consists of 2 hours per week of classroom activity (large size group) and 2 hours weekly with half the students (medium size group).

The 2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

() The evaluation calendar and grading rules will be approved before the start of the course.*

The grade of the subject is obtained from the grades of continuous assessment. The continuous assessment consists of doing different activities, both individual and group, of an additive and formative nature, carried out during the course (inside the classroom and outside it).

Assessment tests consist of questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises.

The final grade (NF) is obtained from the application of the following expression:

$$NF = 0.62 \cdot NA + 0.38 \cdot NC$$

Where

-NE: arithmetic mean of ordinary assessment tests

-NC: arithmetic mean of the activities proposed by the teachers throughout the course.

The student can give up the process of continuous assessment or by communicating it in writing to the teacher responsible at the beginning of the course or for non-attendance at 20% of NC activities. In such case the NF of the subject will be obtained doing:

$$NF = NE$$

Criteria of qualification and of admission to the re-evaluation: The students suspended to the ordinary evaluation that have presented regularly in the proofs of evaluation of the suspended subject will have the option to take a re-assessment test in the period set in the academic calendar. Students who have already passed it or students qualified as not presented will not be able to take the re-assessment test for a subject. The maximum grade in the case of taking the re-assessment exam will be five (5.0). The non-attendance of

a student summoned to the test of re-evaluation, celebrated in the fixed period will not be able to give rise to the realization of another test with later date. Extraordinary assessments will be carried out for those students who, due to force majeure, have not been able to take any of the continuous assessment tests. These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

Test Rules

If any of the laboratory or continuous assessment activities are not performed in the scheduled period, it will be considered a zero score.

Office Hours

To agree

Bibliography

Basic

- Sánchez-Juny, M.; Bladé, E.; Puertas, J. [Hidràulica](#). Barcelona: Edicions UPC, 2005. ISBN 8483018217.
- Puertas, J. ... [et al]. [Apuntes de ingeniería hidráulica](#). A Coruña: Fundación Ingeniería Civil de Galicia, 2016. ISBN 9788461746644.
- Chadwick, A.; Morfett, J.; Borthwick, M. [Hydraulics in civil and environmental engineering](#). 5th ed. Boca Raton: CRC Press, 2013. ISBN 9780415672450.
- Chanson, H. [The hydraulics of open channel flow: an introduction: basic principles, sediment motion, hydraulic modelling, design of hydraulic structures](#). 2nd ed. Oxford [etc.]: Butterworth Heinemann, 2004. ISBN 0750659785.
- Streeter, V.L.; Wylie, E.B.; Bedford, K.W. [Mecánica de fluidos](#). 9a ed. México [etc.]: McGrawHill, 2000. ISBN 9586009874.
- Sotelo, G. [Hidráulica general: vol. 1: fundamentos](#). México: Limusa, 1974. ISBN 9681805038.